240650 - Decision and Negotiation in Industrial Engineering

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 732 - OE - Department of Management
Academic year: 2017
Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 4,5
Teaching languages: Catalan, Spanish

Degree competences to which the subject contributes

Specific:
1. Basic knowledge of industrial production systems.
2. Knowledge applied to business/company organisation.

Teaching staff

Coordinator: Mateo Doll, Manuel
Others: Sánchez Diosdado, José Antonio

Teaching methodology

The course consists of the following training activities:
* Theoretical sessions. A part of these sessions corresponds to a master class (lectures). And the rest is devoted to participatory-guided classes.
* Practical sessions. They correspond to a laboratory class where the students in groups of 3 or 4 apply quantitative tools in order to understand how to apply the procedures introduced in lectures.
* This is complemented by self study and two applied tasks; both types of activities are distance learning.
* Finally, we consider the evaluation activities (mid-term exam, exam on practical exercises and final exam).

Learning objectives of the subject

The theme of modeling decision-making, which began in the courses Organization and Management and Optimization and Simulation, is continued, emphasizing the problem of formalization in situations where decision-making is required in systems. The concept of decision is discussed and the rules for adopting formal schemes are adopted, too.
* Introduce the concepts of decision theory as a tool for analyzing the decision process, basically in a random universe; what is intended with modeling and how it can be formalized a specific situation with models.
* Analyse the problem of decision making: criteria, quantifying the information provided by an experiment, information held by players (game theory), multicriteria decision, the theory of negotiation and multistage decision based on dynamic programming.
* Develop applications to some major problems of industrial engineering (inventory, renewal, search...).

It is intended that at the end of the course the student:
* Identify the types of decision problems and differentiate instant decisions and sequential decisions, and develop appropriate resolution procedures and provide feasible and reasoned solutions.
* Identify which are the best decisions to make in a hostile universe, i.e., identify the type of problem in game theory and provide the best strategy.
* Have the ability to assess possible decisions taken in the context of several simultaneous criteria.
* Differentiate a multistage process of decision making between the short term, with states, and the long term, with the policies.
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* Use appropriate quantitative techniques to help the cited decision making.
* Develop the ability to reason in real situations of decision where management problems are faced.

| Study load | Total learning time: 112h 30m | Hours large group:     | 0h | 0.00% |
|           |                             | Hours medium group:    | 30h | 26.67% |
|           |                             | Hours small group:     | 15h | 13.33% |
|           |                             | Guided activities:     | 0h  | 0.00%  |
|           |                             | Self study:            | 67h 30m | 60.00% |
# 240650 - Decision and Negotiation in Industrial Engineering

## Content

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<th>Decision theory</th>
<th>Learning time: 17h 30m</th>
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<td>Practical classes: 4h 30m</td>
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<td>Laboratory classes: 3h</td>
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<td>Self study : 10h</td>
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### Description:

### Related activities:
Theoretical lecture.
Short-duration activities.
Exercises.

### Specific objectives:
Apply different criteria to decide in uncertain universe.
Differentiate between a priori, a posteriori, marginal, conditional ... probabilities
Draw graphically (using a graph) a decision problem.

<table>
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<th>Game theory</th>
<th>Learning time: 33h 30m</th>
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<td>Practical classes: 9h</td>
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<td></td>
<td>Guided activities: 0h</td>
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<td>Self study : 20h</td>
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### Description:
Introduction to game theory. Classification and formalization (decision trees, strategies, normal form...). Games of two players and zero-sum. Dominant strategies, mix strategies, saddle points, graphic resolution and linear programming. Games of two players and constant sum. Extensions: games of variable-sum, cooperative and no cooperative games, and n-people games.

### Related activities:
Theoretical lecture.
Short-duration activities.
Exercises.
Course task.

### Specific objectives:
Describe a zero-sum game using the normal form and using a decision tree.
Solve a constant-sum game, with sizes 2*2, m*2, 2*n and m*n.
Solve a variable-sum game, either with or without cooperation.
### Sequential decisions

**Learning time:** 33h 30m  
- Practical classes: 9h  
- Laboratory classes: 4h 30m  
- Self study: 20h

**Description:**  

**Related activities:**  
Theoretical lecture.  
Short-duration activities.  
Exercises.

**Specific objectives:**  
Represent a sequential decision problem by a graph.  
Differentiate the resolution in the short-term and long-term horizon.  
Apply the iteration in the state space and draw conclusions from its application.  
Apply the iteration in the policy space and draw conclusions from its application.  
Solve problems using Markov chains for random dynamic programming.

### Multicriteria decision

**Learning time:** 14h 30m  
- Practical classes: 3h  
- Laboratory classes: 1h 30m  
- Guided activities: 0h  
- Self study: 10h

**Description:**  
Concept, formalization and classification. Methods: lexicographical, global function, utility function, cost-benefit, goal programming, Electre, etc.. Problem of collective decision. Coalitions in n-people games.

**Related activities:**  
Theoretical lecture.  
Short-duration activities.  
Exercises.  
Course task.

**Specific objectives:**  
Apply procedures considering several criteria at once.  
Evaluate possible coalitions in n-people games.
<table>
<thead>
<tr>
<th><strong>Negotiation</strong></th>
<th><strong>Learning time:</strong> 13h 30m</th>
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<td>Practical classes: 4h 30m</td>
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<td></td>
<td>Laboratory classes: 1h 30m</td>
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<td>Self study: 7h 30m</td>
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**Description:**

**Related activities:**
Theoretical lecture. Short-duration activities.

**Specific objectives:**
Differentiate possible negotiation models. Analyze bargaining on real cases.
## Planning of activities

| Final exam | Hours: 3h  
| Practical classes: 3h |
|---|---|
| **Description:** | Several theoretical and practical exercises in which the student must demonstrate the ability to apply learned knowledge and to develop specific procedures of resolution. |
| **Support materials:** | It is open books. Electronic devices are not allowed, except pocket calculator (mobile phone or any other devices are not allowed). |

| Mid-term exam | Hours: 1h 15m  
| Practical classes: 1h 15m |
|---|---|
| **Description:** | The student is basically faced to intellectual agility questions and short exercises. |
| **Support materials:** | It is open books. Electronic devices are not allowed, except pocket calculator (mobile phone or any other devices are not allowed). |

| Exam about exercises | Hours: 1h  
| Laboratory classes: 1h |
|---|---|
| **Description:** | The student must demonstrate that he/she is able to solve situations slightly different from those worked out in class. |
| **Support materials:** | It is open books. Electronic devices are not allowed, except pocket calculator (mobile phone or any other devices are not allowed). |

| Evaluation during practical sessions | Hours: 1h 30m  
| Laboratory classes: 1h 30m |
|---|---|
| **Description:** | The student must demonstrate his/her progressive learning during practical sessions. |
| **Support materials:** | Description of the exercise, own resolution and questions proposed by the teachers. |

| Course tasks | Hours: 15h  
| Self study: 15h |
|---|---|
| **Description:** | Students will expand their knowledge and mastery of the subject in extensive and real cases and learn teamwork. |
Support materials:
Description of work for the tasks, material for lectures and material for practical sessions.

Qualification system
The evaluation is done by several methods:
(1) a final exam (EF) with a maximum of three hours duration, consisting of several theoretical and practical exercises in which the student must demonstrate the ability to apply learned knowledge and to develop specific procedures of resolution;
(2) a mid-term exam (PP) with a maximum of 1h15’ duration, in which the student is basically faced to intellectual agility questions and short exercises;
(3) an exam about exercises (EP) with a maximum of 1 hour duration, in which the student must demonstrate that he/she is able to solve situations slightly different from those worked out in class;
(4) evaluation during practical sessions (TP), in which the student must demonstrate his/her progressive learning during practical sessions;
(5) management tasks (TG) in which students must broaden their knowledge and mastery of the subject and learn teamwork.

The final grade for the course Nfinal will be obtained:
Nfinal = 0.6 · Naf + 0.2 Nep + 0.2 · Nac
Naf: final exam evaluation
Naf = EF
Nep: practical sessions evaluation
Nep = max {EP ; 0.5 TP + 0.5 EP }
Nac: progressive learning evaluation
Nac = max { PP ; 0,5 PP + 0,5 TG }

Regulations for carrying out activities
The final exam (EF), the mid-term exam (PP) and the exam about exercises (EP) are open books. Electronic devices are not allowed, except pocket calculator (mobile phone or any other devices are not allowed).
The evaluation during practical sessions (TP) will be held answering the requested questions, during each session.
About the two tasks TG, one will be sent through the campus on the date set at the beginning of the course and the other will be presented in class on a given date, and the mark will consider together the written text and the presentation.
Bibliography

Basic:


Complementary:


Others resources:

Audiovisual material

Transparències de teoria

Slides for lectures

Enunciats de pràctiques i dels treballs

Description of the exercises and course tasks